Plastic City--2045 A. D.

By ERNEST C. GRABILL, Ch. E. IV

Is a plastic bathtub with plastic plumbing in a plastic bathroom in a plastic house exaggerating things a little bit? Well, perhaps, but nevertheless, one school of thought says that in the post-war world, everything under the sun, from penthouses to your favorite helicopter, will be made from plastics. That idea, however, seems to be slightly out of perspective, and while plastics are very versatile materials, the day of plastic cities seems to be far distant. At present, let us assign it to the next century.

Since the discovery of celluloid in 1869, and until the discovery of bakelite in 1909, an average of one new plastic every twenty years was introduced by the industrial research laboratories of the United States. But since the discovery of bakelite, and particularly in the last twelve years, at least one new plastic has been introduced each year.

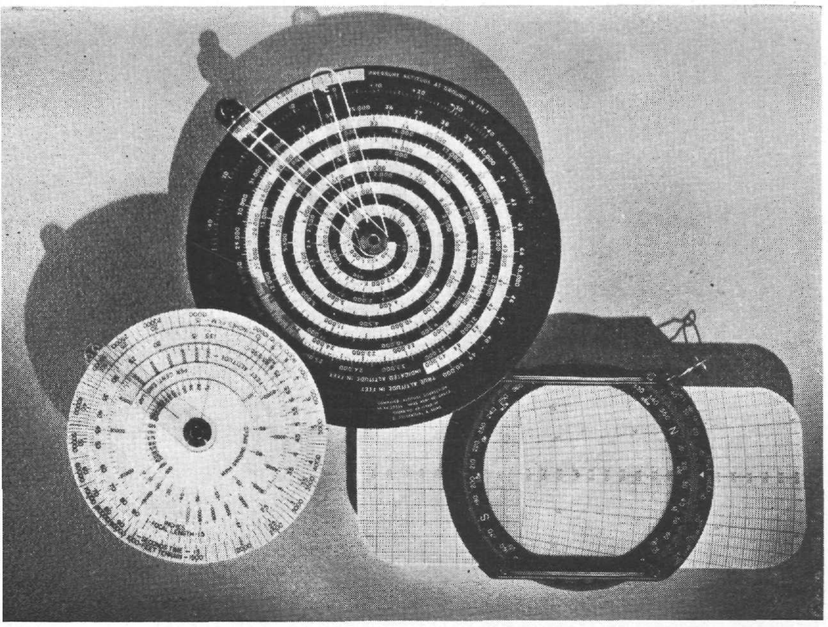
There are literally hundreds of various forms of plastics, but as yet, there is no one all-purpose plastic. In fact, if the present trend continues, plastics will be developed for specific types of work, and not general application. The mere reason that a plastic is good for one thing does not necessarily recommend it for something else. Plastics do not differ from wood, metals, or other materials in this respect.

Another factor to consider in this post-war "plastic city" dream is the obvious fact that plastics will have to compete on the post war market with very cheap materials—cheap in comparison with the present price of the cheapest plastic which is about twelve cents per pound. Until this price takes a sharp nose-dive, plastics can never hope to replace metals and wood as a construction material. Furthermore, for members of reasonable size, plastics do not possess sufficient strength for heavy structural purposes. It must be noted here, though, that certain laminated products do possess high strength, but the plastics industry does not generally consider laminated products as true plastics. They consist of a plastic or resin used as a "bonding" agent for several layers of fabrics, wood, or paper. Plastic bonded plywood has found considerable use in prefabricated houses and airplanes. One widespread use of the material will be for small planes and helicopters after the war. It is expected that helicopters will be used as a major piece of equipment on large orchards and farms for use in spraying.

Even though there probably will be no plastic city in our generation, no industry has much brighter a future than the plastics industry. Wartime expansion of this industry has resulted in very great improvements in the older types, such as nitrocellulose, and in the development of a host of new types, such as plastacele, laminated "lucite-butacite," vinylite resins, and many we haven't even heard of, and probably won't hear of until the end of hostilities. The "age" of novelty plas-

—*Courtesy Bakelite Corporation.*

This picture shows a pair of shoes that were "tipped" with Vinylite resin-coated fabric. They are a pair of tested shoes; they were subjected to as hard a treatment as a nine-year-old boy can give them for over two months. The toes, the points of greatest wear, are as good as new, while the leather uppers show considerable wear.



—*Courtesy of Bakelite Corporation*

Vinylite rigid sheets form permanently accurate and non-warping calculating and measuring instruments. They take printing to close tolerances.

tics has already passed, and plastics now have to stand solely on so-called "engineering" qualities: ease of fabrication, strength, lightness, economy, and not the least, beauty and color.

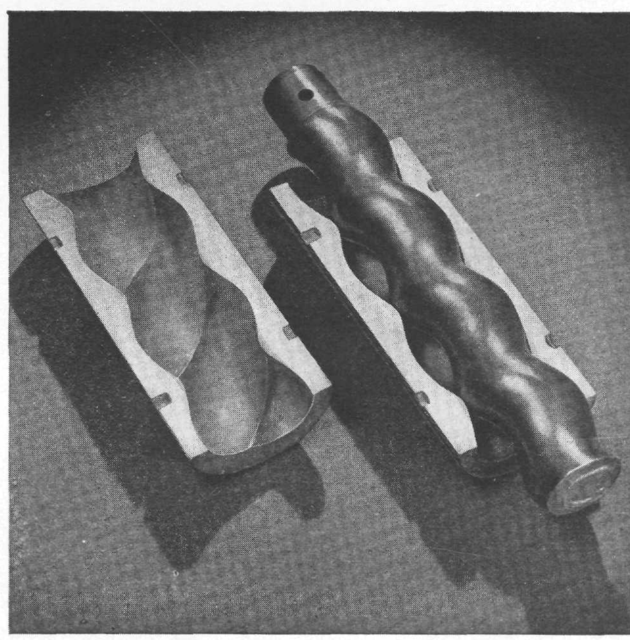
Metal shortages caused by the war have given certain plastics an opportunity to "substitute" for the metals, and in numerous cases, the metals never again will be used for that purpose. For instance, in 1941, approximately 500,000 pounds of metals, mainly tin, were saved by using pyralin cellulose nitrate and other plastics for tipping shoe-laces. Now, 500,000 pounds is not a very great tonnage of metal, as gross tonnages go, but in 1941 and since, saving even 1000 pounds of tin was quite an achievement. These plastic tips, moreover, have been found to be stronger, more compact, and will outlast metal tips.

Another plastic substitute (or "alternate," as the plastics industry prefers) is the use of a hard cellulose nitrate plastic for metal in pens and pencils. The estimated metal saved is about 64 pounds per thousand pencils. Recently, a new plastic lithographic printing plate was developed. This plate, it is claimed, saves from three to eight times its weight in aluminum and zinc. These plates, now pre-empted by the Army and government agencies, are made from polyvinyl alcohol resin. They are used by the Army's mobile field printing units. They give about the same number of impressions as metal plates, and carry about 25% more ink without smudging.

Some other "invasions" of plastics into the metal world are oil-resistant tubing and gaskets, covers to protect openings in airplane and tank engines during shipping and assembly, oil-viewers and filler caps for cream separators, door knobs, bathroom fixtures, bearings for juice extractors, spacers for milling operations, and rotors for ultracentrifuges. A composite 1942 electric refrigerator has about fifty plastic parts; for example, door medallions, evaporator door name plates, thermometer case or housing, evaporator door panel, and handle. It is interesting to note that the 1942 automobile had about 120 plastic parts; airplanes vary from twenty for small planes to a hundred or more on large four-motored planes. A substantial number of these are metal replacements.

The plastic which makes up the "blisters" on fighting planes is a "lucite-butacite" laminated plastic. It is methyl methacrylate resin. Acrylic resins are characterized by their colorless transparency (a tremendous aid to navigation), adhesive qualities, and elasticity. Laminated "lucite-butacite" is shatter-resistant, light-weight, and easily formed and mounted. In a number of tests, DuPont engineers shot 50-caliber machine gun bullets through semi-cylinders made of solid acrylic resin and the laminated plastic. They found that at —40°F., and with a pressure

(Please turn to page 28)



—*Courtesy of Bakelite Corporation*

Fabric-based laminated plastics are used as pump stators, which are resistant to such hydrocarbons as propane, butane and most vegetable oils.

PLASTIC CITY

(Continued from page 14)

differential of 7.5 p.s.i., the acrylic semi-cylinder ruptured completely, while the laminated one did not. In fact, the size of the hole left in the laminated one was so small that the rate of pressure loss was small and enabled quick patching. At higher temperatures, laminated "lucite-butacite" is completely self-sealing. This substance absorbs a greater percentage of ultra-violet rays than solid acrylic and is of value in minimizing sunburn. It also absorbs a large portion of the heat-generating infra-red rays.

This dissertation about plastics certainly would not be complete without some mention of nylon. Nylon is a *plastic* as well as a synthetic fiber. As such, its largest use has been as brush bristles, It is a superb material for this application, since it will not rot or dry out and wears longer than natural bristles. Nylon brushes are famous for the ease with which they may be cleaned. It is used in over 90 per cent of the quality toothbrushes and in greater than 50 per cent of the hairbrushes in this country. Nylon bearings have been made and used successfully, but this is still pretty much in the experimental stage. The only lubricant needed is water. The newest addition to the nylon family is a thermo-plastic, a plastic whose form is not necessarily permanent. It may be reheated and reformed a number of times. Most thermo-plastics soften at about 160°F. The highest softening point obtained was around 280°F. until the new nylon was discovered. It does not soften until the temperature reaches about 450°F. This temperature is near the charring point for thermosetting materials. Thus nylon is a thermoplastic which has overcome the fundamental failing of this kind of plastic and has the basic advantage of the thermosetting type.

Nylon is very light and at the same time very tough. A molding about the size of a match box can be stepped upon, and though it gives a little, it comes back to its original shape.

Fabrics coated with nylon are somewhat shiny, but wear well and do not crack or scuff. It can be made to resemble kid or calf, and may be used for shoes, handbags, and luggage. Other unique but important and essential uses of nylon include medical uses, such as brain plates, cups to reline arthritic hips, sutures, artificial eyes, contact lenses, artificial fingers, and windows for oxygen tents.

The list could go on and on, but again, realize that nylon is not a "cure-all"—we cannot build houses out of it—yet—but the list of specific uses keep growing. There are nylon, bakelite, pyralin, styron, vinylite, durite, indur, and a host of other trade names—all signifying some *particular* type of plastic—developed for a specific use. All of them, old and new, will be available for building the better world tomorrow that we all envision today.